

Magalia Fire Salvage Project Soils and Watershed Input

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Date

Watershed Actions

- Improve railroad grade for water quality
 - Ephemeral stream is diverted down railroad grade for approximately 4,815 ft. and enters an intermittent stream on private.
 - Construct at least 4 armored rolling dips and 2 low water crossings to resolve the hydroconnectivity issue. Other drainage features may be constructed if conditions worsen by the time funding becomes available.
- Obliterate or improve unclassified road in Township 23 North, Range 4 East, Section 18 below the railroad grade to improve water quality.
 - Three segments of hydroconnectivity were found.
 - Potential work ranges from ripping the road to constructing dips to disconnect the sediment into the streams.
- Waterbar a skid trail that is adding sediment to the unclassified road mentioned above.

Restrictions/Design Features

- All skid trails and temporary roads will have waterbars as erosion control features.
- Adhere to FS-990a National Best Management Practices for Water Quality Management on National Forest System Lands, Volume 1: National Core BMP Technical Guide (April 2012), in particular:
 - Mechanical Vegetation Management Activities: Veg 1-4 (especially Veg -3, Aquatic Management Zones), 6, and 8; pgs. 128-140.
- Adhere to R5 FSH 2509.22 Soil and Water Conservation Handbook, Chapter 10 Water Quality Management Handbook, Amendment # 2509.22-2011-1 (Dec 05, 2011). In particular, BMPs 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.8, 1.9, 1.10, 1.11, 1.12, 1.13, 1.14, 1.15, 1.16, 1.17, 1.19, 1.20, 1.21, 2.2, 2.3, 2.4, 2.5, 2.6, 2.8, 2.11, 5.1, 5.2, 5.4, and 5.6.
- More design specific design features are located in project appendix that contains all the resources' design features/mitigations. Below are some of the most crucial for soils and watershed.
 - See Table 1 for the RCA Heavy Equipment Exclusion Zone
 - Limiting Operating Period (LOP) (BMP 1-5, BMP 1-13) for soil moisture.
 - Conduct ground based harvest operations when soil is dry; that is, in the spring when soil moisture in the upper 8 inches is not sufficient to allow a soil sample to be squeezed and hold its shape, or will crumble when the hand is tapped. In the summer and early fall after storm event(s) when soil moisture between 2-8 inches in depth is not sufficient to allow a soil sample to be squeezed and hold its shape, or will crumble when the hand is tapped. Work on streams should occur during low flow (late summer)
 - Lop and scatter broken tops and limbs throughout the project boundary to increase the effective soil cover. Minimize the amount of slash that goes to landings instead use

- material for effective soil cover. Concentrate effort on steeper slopes and areas along the riparian corridor. Re-use existing landings and skid trails where possible (BMP 1-12).
- Fuel outside of riparian areas. 300 feet on perennial and 150 feet on seasonal flowing streams.
 - BMP 2.11 (Equipment Refueling and Servicing) will prevent fuels, lubricants, cleaners, and other harmful materials from discharging into nearby surface waters or infiltrating through soils to contaminate groundwater resources.

Table 1. RCA Heavy Equipment Exclusion Zone Widths and Slope Restrictions

Stream Type	Riparian Conservation Area (RCA) Widths	Equipment Exclusion Zone (EEZ) for Mechanical Thinning via Salvage, Roadside Hazard Tree Removal, and Grapple Pile		Mastication	Underburn*	Hand Cut**	Minimum Distance to Burn Piles
		Slope <35%	Slope >35%				
Perennial streams	300 feet	100 feet	Excluded	50 feet	150 feet	No buffer	25 feet
Intermittent streams	150 feet	100 feet	Excluded	50 feet	150 feet	No buffer	25 feet
Ephemeral streams	150 feet	50 feet	Excluded	25 feet	150 feet	No buffer	25 feet
Special Aquatic Features (Reservoirs, wetlands, fens, and springs)	300 feet	100 feet	Excluded	50 feet	150 feet	Perimeter	25 feet
Riparian Features: dry meadows, seasonal wetlands	150 feet	50 feet	Excluded	25 feet	150 feet	Perimeter	25 feet

* Prescribed burning would be allowed within RCAs, but there would be no ignitions in riparian vegetation. Fire may back through this zone.

**May hand cut within RCA feature but don't cut riparian vegetation. Don't cut vegetation that provides stream bank stabilization. Adhere to the minimum distance for burn piles. No hand cutting within special aquatic features and riparian features unless marked by hydrologist and/or biologist.

Hydrology Analysis

The SNFPA ROD describes management direction for riparian areas and water resources located on Plumas National Forest System lands. The ROD identifies goals for aquatic, riparian, and meadow ecosystems and associated species known as Aquatic Management Strategy (AMS) goals. The ROD includes six Riparian Conservation Objectives (RCOs) and more than thirty standards and guidelines to be implemented for designated Riparian Conservation Areas (RCAs). The RCOs were created as a strategy as to achieve the AMS goals. The AMS goals are: (1) Water Quality, (2) Species Viability, (3) Plant and Animal Community Diversity, (4) Special Habitats, (5) Watershed Connectivity, (6) Floodplains

and Water Tables, (7) Watershed Condition, (8) Streamflow Patterns and Sediment Regimes, (9) Stream Banks and Shorelines (USDA Forest Service. 2004).

Designation of appropriate widths of RCAs is an integral element of the riparian area management. The standard and guide for Riparian Conservation Area (RCA) widths suggested by the ROD are described below.

- Perennial Streams: 300 feet on each side of the stream, measured from the bank full edge of the stream
- Seasonally Flowing Streams (includes intermittent and ephemeral streams): 150 feet on each side of the stream, measured from the bank full edge of the stream
- Special Aquatic Features or Perennial Streams with Riparian Conditions extending more than 150 feet from edge of streambank or Seasonally Flowing streams with riparian conditions extending more than 50 feet from edge of streambank: 300 feet from edge of feature or riparian vegetation, whichever width is greater

RCA widths mentioned above may be adjusted at the project level if a landscape analysis has been completed and a site-specific Riparian Conservation Objectives (RCO) analysis demonstrates a need for different widths which did occur for this project. The adjusted widths are listed and described in Table 1.

Direct and Indirect Effects

The primary treatment is to salvage trees in those areas affected by the 2018 Camp Fire via mechanical thinning. A direct effect of the proposed action is that effective soil cover will be increased in units 1 and 3 because the broken tops and limbs of the felled trees will be left in place or redistributed in RCAs. Increasing the effective soil cover is an improvement over the existing condition where little to no effective soil cover is present to effectively stop erosion. The amount of increased soil cover is hard to predict and there is a probability that we won't be able to achieve a minimum 50 percent effective soil cover but still would be an improvement. An indirect effect of implementing the project is that erosion and the amount of sediment entering into Magalia Reservoir and Lake Oroville will be qualitatively lower. The design features and BMPs are intended to protect the water quality while moving forward with the projects intent to remove salvage and hazardous trees. One example is that having a LOP on soil moisture and limiting the number of passes a rubber-tired skidder has over the same piece of ground in RCAs will help reduce the possibility of channelized flow while still increasing effective soil cover by leaving the broken tops and limbs. The implementation of the project is not expected to cause any direct and indirect significant negative effects to the waters of the municipal watersheds.

Other planned activities besides the initial salvage are site prep for planting and maintenance of the landscape for fuels. The site prep treatments include grapple pile, planting and grubbing after planting. The site prep treatments should not cause any direct and indirect effects to the projects waters and its beneficial uses. BMPs and design features will be in place to protect water quality which are located in the mitigation table of the project.

The maintenance for fuels reduction can include mastication, hand cut pile burn, grapple pile, grazing and underburn. These treatments will not have direct and indirect effects to water quality as long as they adhere to RCA buffers (Table 1), BMPs, and design features.

Two major hydrological issues were discovered when surveying for the project. First is the railroad grade that passes through the project diverts an ephemeral stream for approximately 4,815 ft. and enters an intermittent stream on private. It also diverts another ephemeral stream down the same segment for about 2,600 ft. In addition the railroad grade adds sediment to two other streams below the railroad grade. The goal is to hydrologically disconnect the railroad grade from the impacted streams. The manner in which it can be achieved is by constructing at least 4 armored dips and two low water crossings. Other drainage features may be constructed if conditions worsen by the time funding becomes available. The direct and indirect effects disconnecting the railroad grade from streams is minimal. Long-term water quality will be improved because no more sediment would be entering the streams.

The second major hydrological issue is an unclassified (non-system) road just below the same segment of railroad just discussed has a major rill that is depositing sediment into an intermittent stream. The hydrological connected (hydroconnectivity) segment is approximately 929 ft. This non-system road has two other segments of 191 ft. and 219 ft. of hydroconnectivity. In order to fix this issue two options are being considered obliteration or improving the unclassified (non-system) road. Obliteration would encompass ripping the road, add slash and/or weed free straw for effective soil cover and removing a culvert. Improving the unclassified road would be to fix the rill via filling the road bed, adding armored dips, rocking the road, cleaning the culvert and constructing low water crossings.

A skid trail was found to be depositing sediment to the unclassified road mention above therefore the proposed fix is to waterbar the skid trail. No direct and indirect effects are expected from this action.

The construction of the fore mentioned features will be done when the streams are not flowing or when flows are minimal. In addition BMPs and design features will be in place to minimize impacts to water quality. Long-term water quality and its beneficial uses would be improved because the issues identified got fixed.

Cumulative Effects

The Cumulative Watershed Effects (CWE) analysis is based on the guidance from the Forest Service Handbook FSH 2509.22-Soil and Water Conservation, Region 5 Amendment (USDA Forest Service 1988). Effects may be either beneficial or adverse and are a result of combined effects of multiple management activities within a watershed. Beneficial uses for waters in the project are identified below the RCO analysis. Alterations to watershed hydrology are believed to be the most probable mechanism for initiating these effects to aquatic habitat (USDA Forest Service 1988). The Region 5 Forest Service Handbook amendment utilizes conceptual site disturbance coefficients called equivalent roaded acres (ERA) to track changes in the hydrologic functioning of watersheds. ERA coefficients are used to compare the effect of management activities (e.g. timber harvest or pile burning) to the effect of a road in terms of altering surface runoff patterns and timing. The sum of these coefficients represents the

percentage of watershed in road surface that would produce the same effects as the existing or planned distribution of management activities (Berg et al, 1996).

Watersheds and stream channels have a natural capacity to absorb various levels of land disturbance without major adjustment to their function and condition. However, there is point where additive or synergistic effects of land use activities would cause a watershed to become highly susceptible to cumulative effects. This upper estimate of watershed “tolerance” to land use is described as the threshold of concern (TOC). When the sum of disturbances exceeds the TOC, water quality may be impaired for established beneficial uses, such as aquatic habitat. Stream channels and water quality can deteriorate to the point where adjacent riparian areas and wetlands become severely damaged.

Project level TOCs are estimated by considering the sensitivity of each analyzed watershed. Natural watershed sensitivity is an estimate of a watershed’s ability to absorb land use impacts without increasing the effects of cumulative impacts to unacceptably high levels (USDA Forest Service 1988). For this project, the TOC has been conservatively set at 14 percent across all project specific watersheds. The ERA total of each watershed, expressed as a percentage of the watershed area, is compared to the TOC and reported as a fraction (percent) of the TOC. ERA totals in the range of 90 to 99 percent of TOC are considered to be approaching TOC, while those that are 100 percent or greater equal or exceed the TOC. The TOC does not represent an exact level of disturbance where cumulative watershed effects will begin to occur. Rather, it serves as an indicator of increased risk of significant adverse cumulative effects occurring within a watershed. If a watershed is approaching or above the TOC, a more thorough analysis of the activities planned within the watershed is necessary.

The project falls within the communities of Paradise and Magalia which burned in the 2018 Camp Fire. Certain sections of the watersheds have a soil burn severity of moderate and high. In addition high urbanization in these watersheds it’s assumed that the watersheds are over TOC under existing condition. The implementation of this project is not going to cause any significant cumulative effects to the watersheds relative to the existing condition because of the BMPs and specific design features to improve effective soil cover along RCAs. These features are designed to improve the existing condition by trying to minimize the amount of erosion that would affect the beneficial uses. The proposed railroad grade improvements, and the unclassified road decommissioning or improvements will help improve the watersheds beneficial uses as well.

The fact that the watersheds are over TOC means that an additional step of monitoring will occur. The goal of forensic monitoring is to monitor the project in the winter for “potential or actual sources of sediment in a timely manner so that rapid corrective action may be taken where feasible and appropriate (CRWQCB 2017 pg. 6).”

Soil Analysis

The soils analysis looked at the soils hydrologic function and ability to support plant growth. The indicators and measures used for the analysis are listed in Table 2. The qualitative analysis will disclose the existing condition and compare that to the proposed activities. The project has identified specific Best

Management Practices (BMPs) and mitigations identified in the restrictions/design features section of this document and in the design feature appendix.

Table 2 Soil Function Check List Used for Soil Affects Analysis

Soil Function	Indicator & Measure
Soil Hydrologic Functions	Soil Stability & <u>Percent Effective Soil Cover</u>
Support for Plant Growth	Surface Organic Matter & <u>Percent Fine Organic Matter</u>
Support for Plant Growth and Soil Hydrologic Functions	Soil Structure and Macro-porosity & <u>Percent Compaction</u>

Existing Condition

Percent effective soil cover, percent fine organic matter, and percent compaction is unknown since soil surveys were not conducted. The soil Erosion Hazard Rating (EHR) for the project is moderate therefore 50 percent effective soil cover is the standard. Based on field visits in March 2019 and professional judgement effective soil cover and fine organic matter will not be meeting standard and guidelines for units 1 and 3. Soil compaction was not determined at the time of the field visit instead specific design features will be in place for proposed project. The Camp Fire burned approximately 32,282 acres of Forest Service (FS) land. The soil burn severity (SBS) on Forest Service land for moderate is 6,434 acres (19.9% SBS on FS) and 1,015 acres for high (3.1% SBS on FS).

In unit 1 only 17% was determined to have a moderate SBS. However, field visits to the unit indicate that are much larger area burned at a moderate intensity. Ocular estimates of effective soil cover are below the standard of 50 percent for effective soil cover. Effective soil cover is defined as duff and litter greater than ½ inch in depth, surface gravels greater than ¾ inch in diameter, woody debris greater than ¼ inch in diameter, and living vegetation count as effective soil cover. If effective soil cover does not meet its standard then percent fine organic matter will not meet its desired condition of 50 percent or greater. Fine organic matter is composed of duff and litter greater than ½ inch in depth and woody debris between ¼ to 3 inches in diameter. Unit 1 was observed to have issues with erosion because of the topography and the number of streams found. These issues are discussed in the hydrology portion of analysis.

Unit 2 does meet the standard for percent effective soil cover and desired condition of percent fine organic matter. Unit 2 showed no evidence of erosion because the fire only burned at a low intensity resulting in unburned and low SBS.

Almost all (96%) of unit 3 had a SBS of moderate and high. Unit 3 was worst of all units in terms of lack of effective soil cover and fine organic matter. The unit is on a ridge top and had little to no erosion over the winter.

Proposed Action

Direct, Indirect, and Cumulative Effects

Percent Effective Soil Cover, Percent Fine Organic Matter, & Percent Compaction

The proposed project has 3 distinct phases. First is to salvage the trees as a result of the Camp Fire that went through in 2018. Second phase is to site prep the area for planting. Third phase is to keep the fuels down by maintaining the landscape through many different treatments.

The proposed salvage of the dead and hazardous trees is not going to negatively affect the effective soil cover and percent fine organic matter because of the various design features and mitigations of project. The broken tops and limbs of the trees will be lopped and scatter to improve overall effective soil cover and organic matter. The amount of slash that goes to landings will be minimized instead the material would be used for effective soil cover in order to promote soil stability. The slash placement will be prioritized on steeper slopes, areas along the riparian corridor, and skid trails. The percent increase in effective soil cover and organic matter is hard to predict but it would be an improvement from the existing condition and will help with soil stability and future soil nutrients. To minimize the amount of soil disturbance, logging systems will have to use existing landings and skid trails plus restrict the use of any heavy equipment to 35 percent. A soil moisture LOP would be in place for the use of heavy equipment which will minimize ruts and compaction therefore keep the erosion to a minimum.

Site prep treatments such as grapple piling, planting and grubbing short-term will disturb the ground and may cause some erosion. However, the grapple piling and grubbing will have to adhere to the RCA buffers identified in Table 1. RCA Heavy Equipment Exclusion Zone Widths and Slope Restrictions Table 1. The project will have BMPs and design features to keep the amount of erosion to a minimum. The proposed site prep activities are not expected to change the soils hydrologic function and its ability to support plant growth.

The third phase includes various treatments such as mastication, hand cut pile burn, grapple pile, grazing, and underburn in order to maintain the fuel levels low. These treatments are less disturbing to soils across the projects landscape when compared to the salvage component of the project. Mastication is more likely to increase effective soil cover and fine organic matter because it rearranges the fuels down to the ground as copped up organic matter. Hand cut pile burn will decrease effective soil cover and fine organic matter but it will be minimal because those reductions are isolated to those piles. Grapple pile is anticipated to be the more disturbing treatment to effective soil cover and fine organic matter because it rearranges the fuels into larger piles which are eventually consumed by fire. Grazing will have design features to keep the amount of fuel consumed by goats to acceptable levels where they don't leave soil bare to appoint were erosion becomes an issue. Underburning would occur under prescribed conditions that would not result in the complete combustion of the duff and litter layer. Instead it will burn in a mosaic pattern only consuming the fine organic matter where the fire went through. The underburning within the RCA buffers would have a mosaic pattern due to the varying moisture conditions and the impacts should be minimal and not significant to effective soil cover. The BMP effectiveness was rated as 92 percent for underburn units for 2011. The 2011 Best Management Practices Evaluation Program

(BMPEP) Report found that the implementation and effectiveness of the BMPs for 2011 was at 100 percent and 97 percent, respectively (USDA Forest Service 2011b). Specific BMPs and design features will be in place to keep the soils functions working. The various treatments for maintaining the landscape are not expected to cause significant issues for the soils hydrologic function and ability to support plant growth.

References

Berg, N., Roby, K., & McGurk, B. 1996. "Cumulative Watershed Effects: Applicability of Available Methodologies to the Sierra Nevada." In Sierra Nevada Ecosystem Project: Final Report to Congress, vol. III, report 2. Davis: University of California, Centers for Water and Wildland Resources.

California Regional Water Quality Control Board, Central Valley Region, 2017. ORDER NO. R5-2017-0061: Attachment B Monitoring and Reporting for Order No. R5-2017-0061.

USDA Forest Service. 1988. Plumas National Forest Land and Resource Management Plan and Final Environmental Impact Statement. Pacific Southwest Region, San Francisco, CA.

USDA Forest Service. 2004. Sierra Nevada Forest Plan Amendment Record of Decision. USDA Forest Service, Pacific Southwest Region, Vallejo, CA.

USDA 2011a. BMP Water Quality Management Handbook Amendment - 2509.22_10. FSH Amendment, Vallejo: USDA Forest Service, Vallejo CA.

USDA Forest Service 2011b. 2011 Best Management Practices Evaluation Program Report. USDA, 2011.